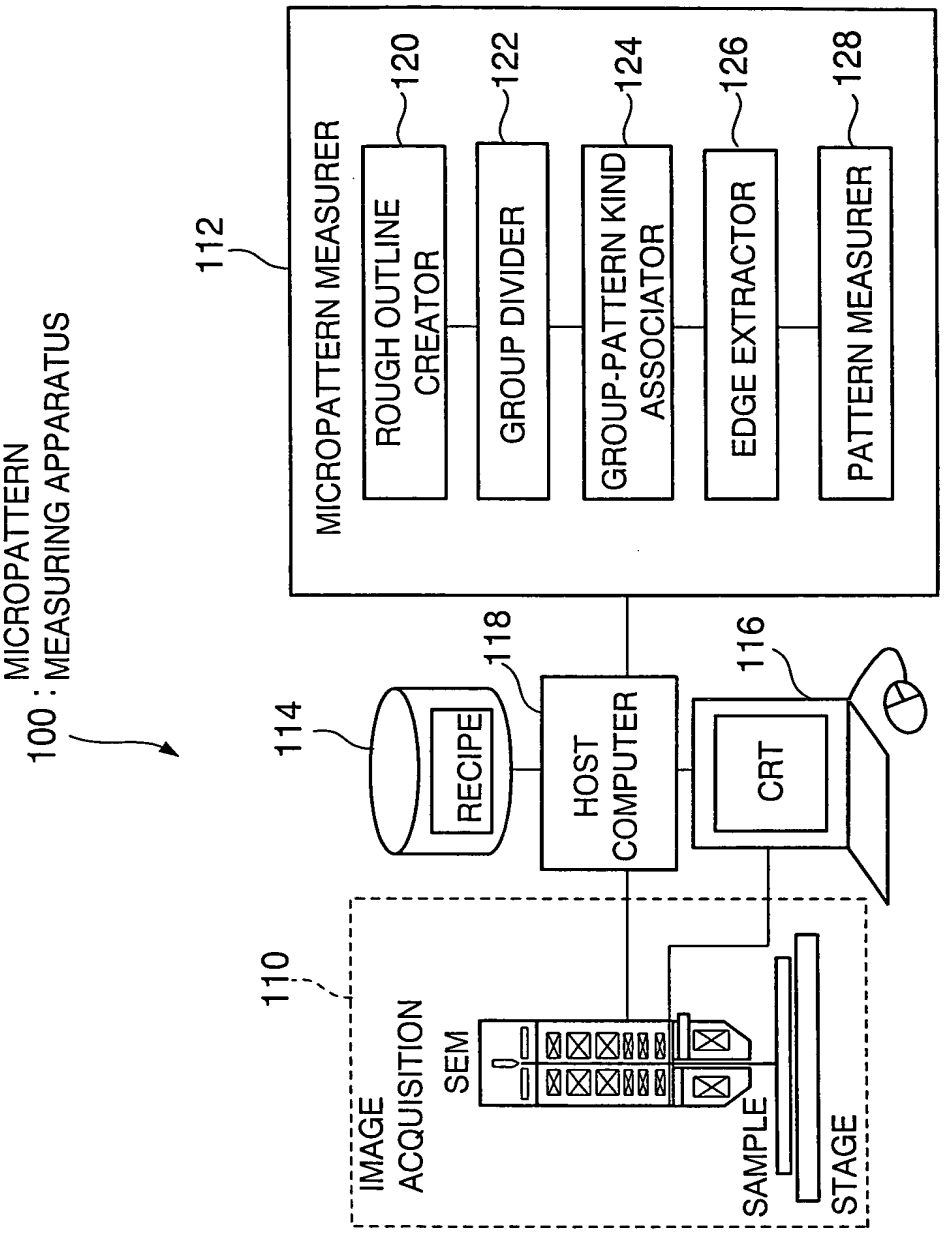

100 : MICROPATTERN MEASURING APPARATUS
112
MICROPATTERN MEASURER
120
ROUGH OUTLINE CREATOR
122
GROUP DIVIDER
124
GROUP-PATTERN KIND ASSOCIATOR
126
EDGE EXTRACTOR
128
PATTERN MEASURER
114
RECIPE
118
HOST COMPUTER
116
CRT
110
IMAGE ACQUISITION
SEM
SAMPLE
STAGE

FIG. 1

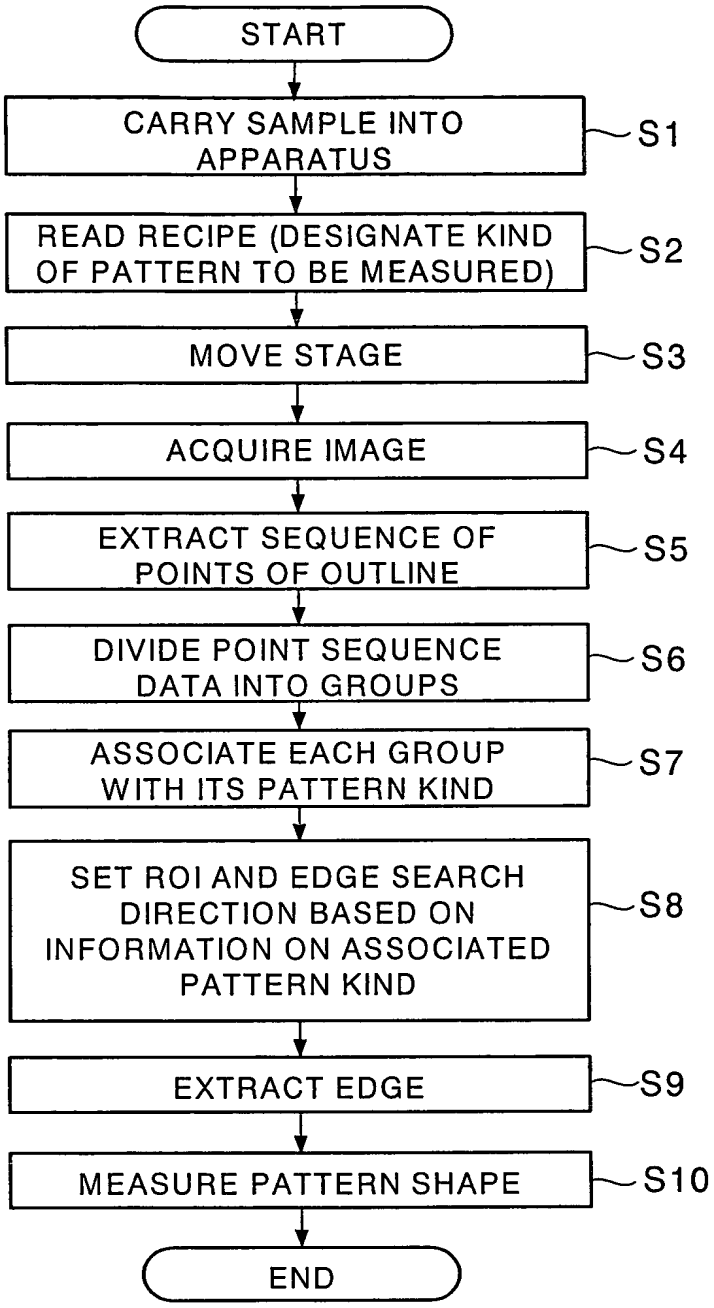

START
CARRY SAMPLE INTO APPARATUS
S1
READ RECIPE (DESIGNATE KIND OF PATTERN TO BE MEASURED)
S2
MOVE STAGE
S3
ACQUIRE IMAGE
S4
EXTRACT SEQUENCE OF POINTS OF OUTLINE
S5
DIVIDE POINT SEQUENCE DATA INTO GROUPS
S6
ASSOCIATE EACH GROUP WITH ITS PATTERN KIND
S7
SET ROI AND EDGE SEARCH DIRECTION BASED ON INFORMATION ON ASSOCIATED PATTERN KIND
S8
EXTRACT EDGE
S9
MEASURE PATTERN SHAPE
S10
END

FIG. 2

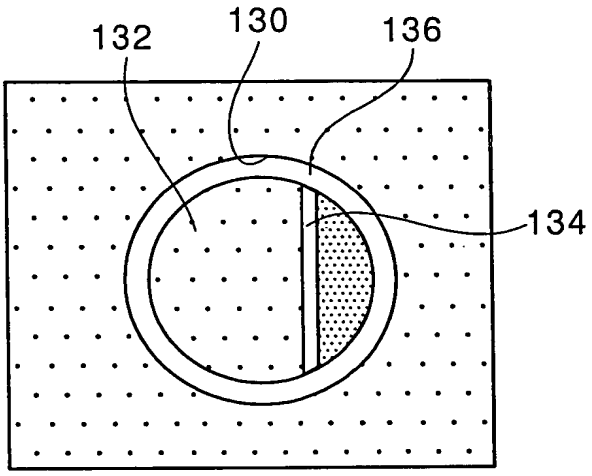


FIG. 3

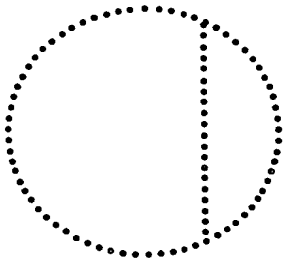


FIG. 4

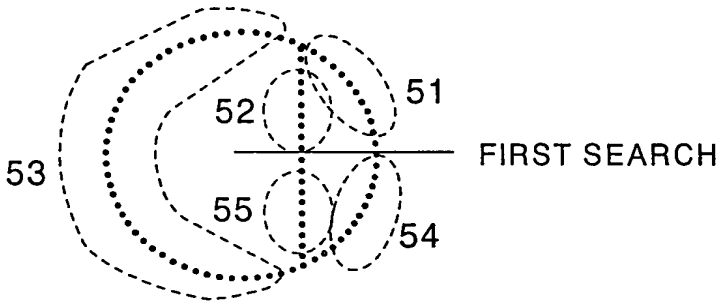


FIG. 5

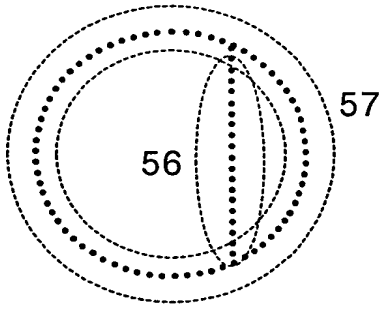


FIG. 6

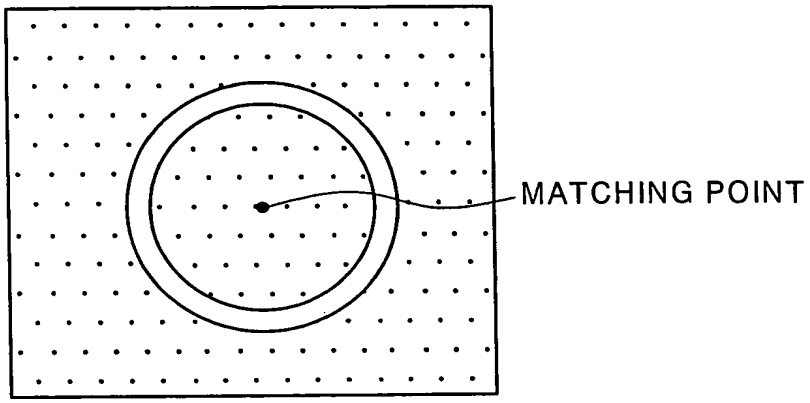


FIG. 7

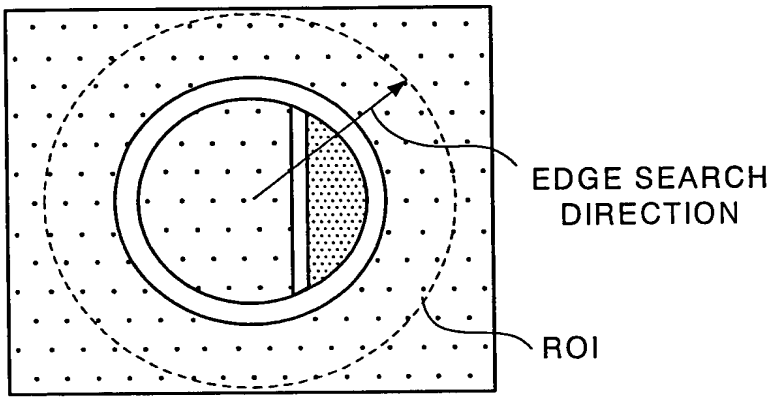


FIG. 8

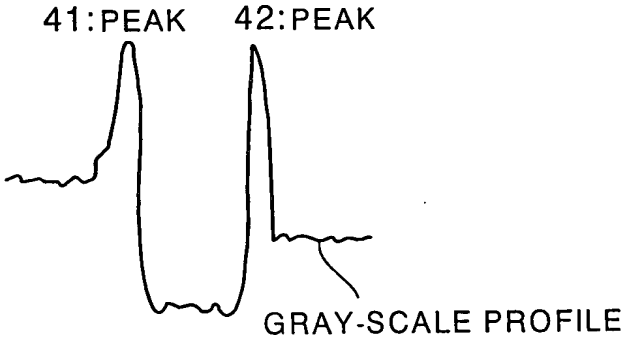


FIG. 9

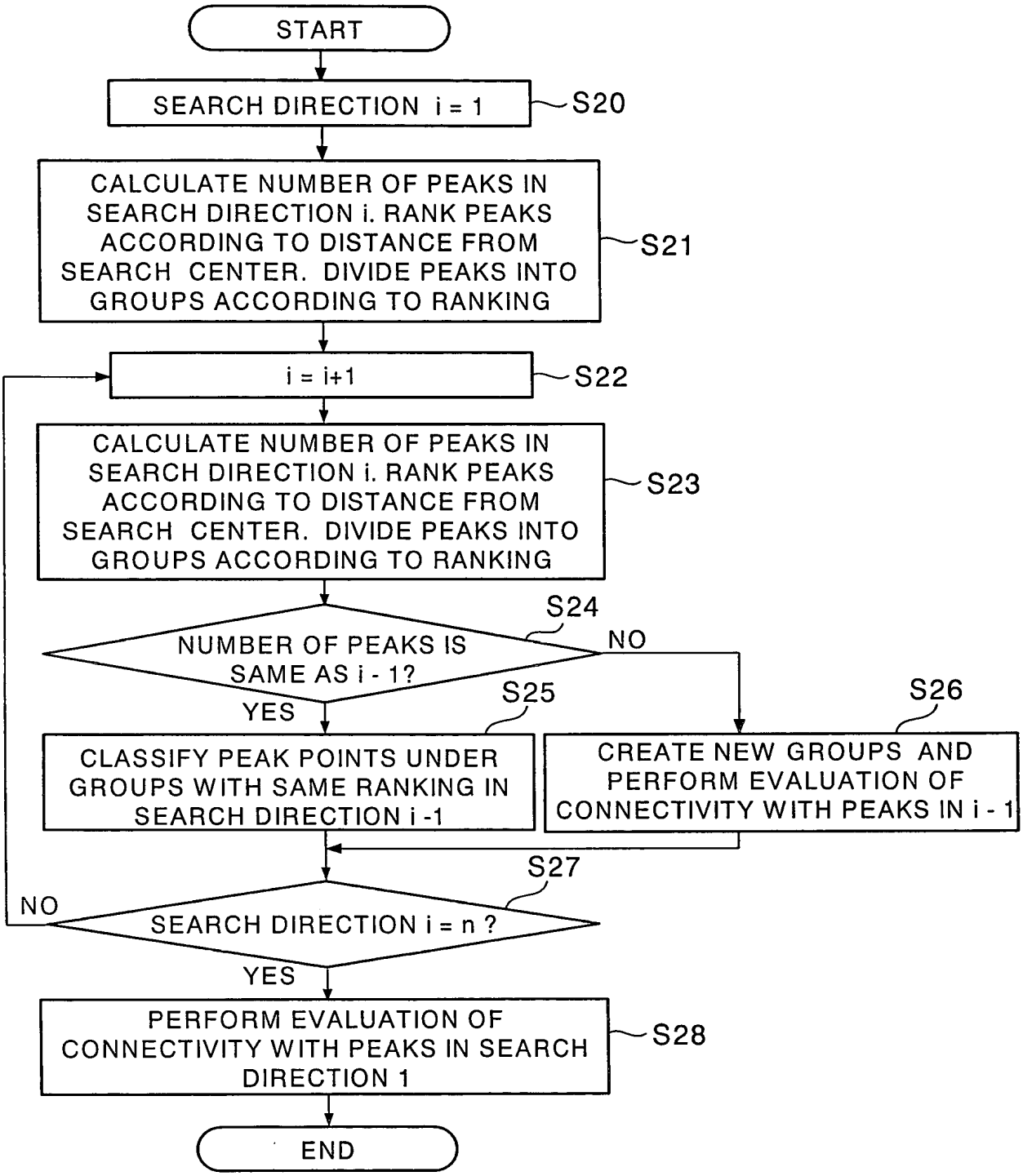

START
SEARCH DIRECTION i = 1
S20
CALCULATE NUMBER OF PEAKS IN SEARCH DIRECTION i. RANK PEAKS ACCORDING TO DISTANCE FROM SEARCH CENTER. DIVIDE PEAKS INTO GROUPS ACCORDING TO RANKING
S21
i = i+1
S22
CALCULATE NUMBER OF PEAKS IN SEARCH DIRECTION i. RANK PEAKS ACCORDING TO DISTANCE FROM SEARCH CENTER. DIVIDE PEAKS INTO GROUPS ACCORDING TO RANKING
S23
S24
NUMBER OF PEAKS IS SAME AS i - 1?
NO
YES
S25
CLASSIFY PEAK POINTS UNDER GROUPS WITH SAME RANKING IN SEARCH DIRECTION i -1
S26
CREATE NEW GROUPS AND PERFORM EVALUATION OF CONNECTIVITY WITH PEAKS IN i - 1
S27
NO
SEARCH DIRECTION i = n ?
YES
PERFORM EVALUATION OF CONNECTIVITY WITH PEAKS IN SEARCH DIRECTION 1
S28
END

FIG. 10

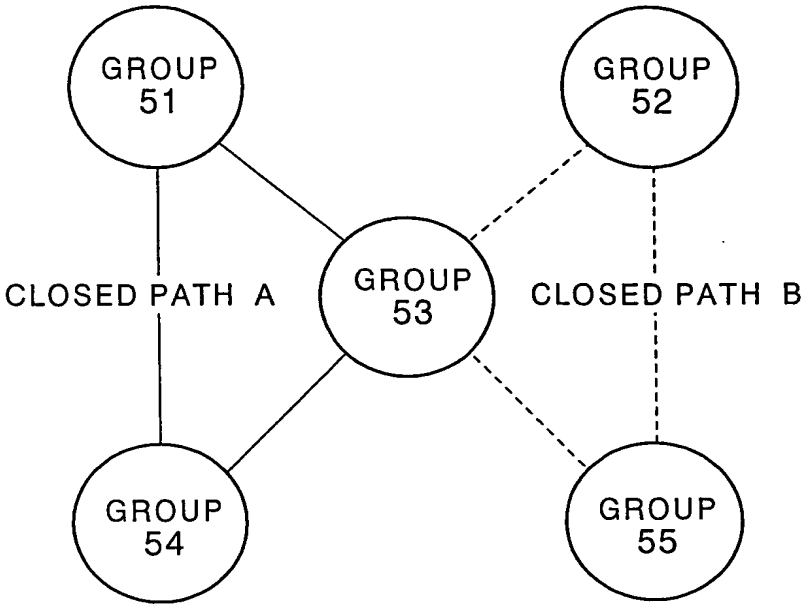

GROUP 51
GROUP 52
CLOSED PATH A
GROUP 53
CLOSED PATH B
GROUP 54
GROUP 55

FIG. 11

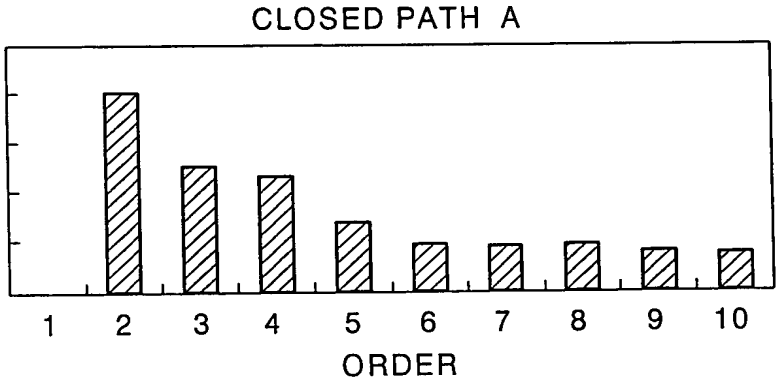

CLOSED PATH A
1
2
3
4
5
6
7
8
9
10
ORDER

FIG. 12

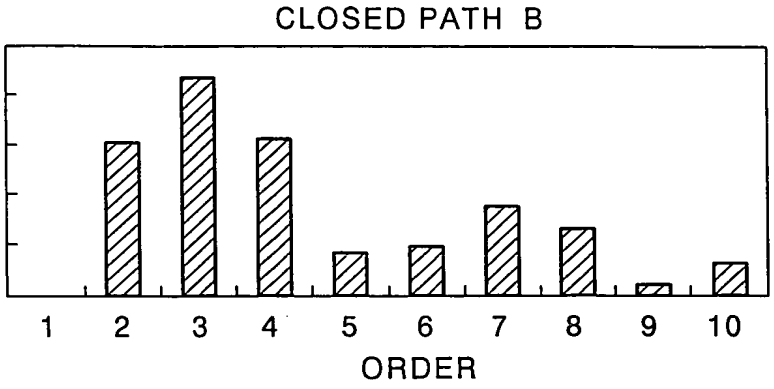

CLOSED PATH B
1
2
3
4
5
6
7
8
9
10
ORDER

FIG. 13

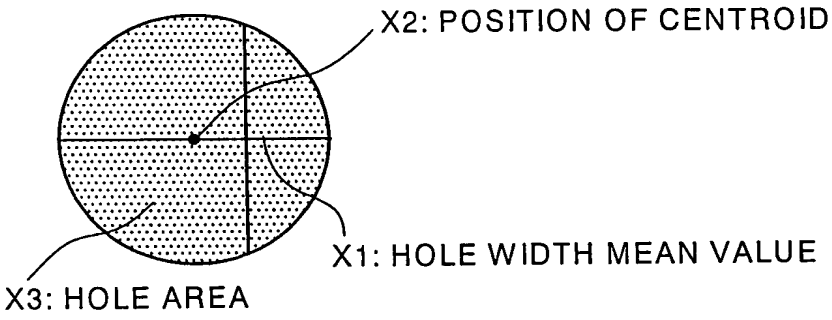

X2: POSITION OF CENTROID
X1: HOLE WIDTH MEAN VALUE
X3: HOLE AREA

FIG. 14

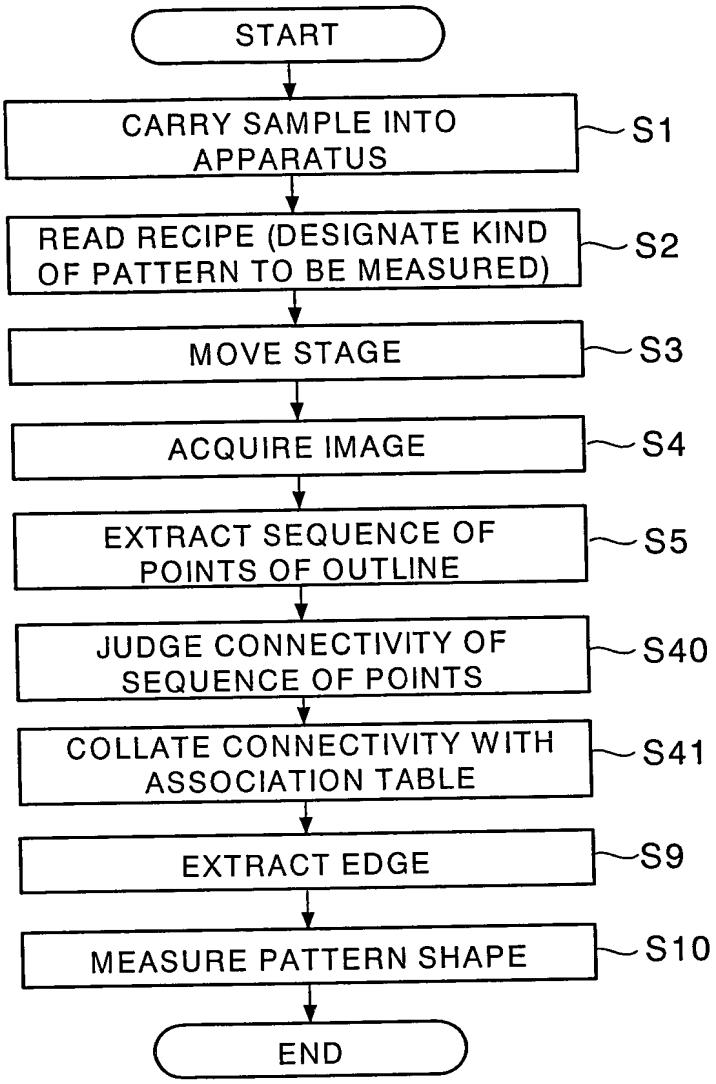

START
CARRY SAMPLE INTO APPARATUS
S1
READ RECIPE (DESIGNATE KIND OF PATTERN TO BE MEASURED)
S2
MOVE STAGE
S3
ACQUIRE IMAGE
S4
EXTRACT SEQUENCE OF POINTS OF OUTLINE
S5
JUDGE CONNECTIVITY OF SEQUENCE OF POINTS
S40
COLLATE CONNECTIVITY WITH ASSOCIATION TABLE
S41
EXTRACT EDGE
S9
MEASURE PATTERN SHAPE
S10
END

FIG. 15

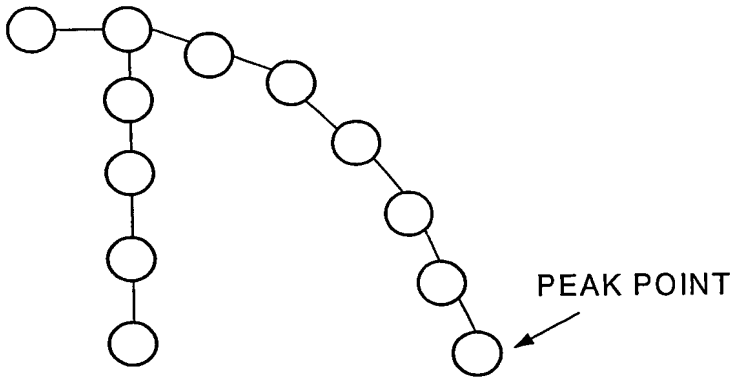


FIG. 16

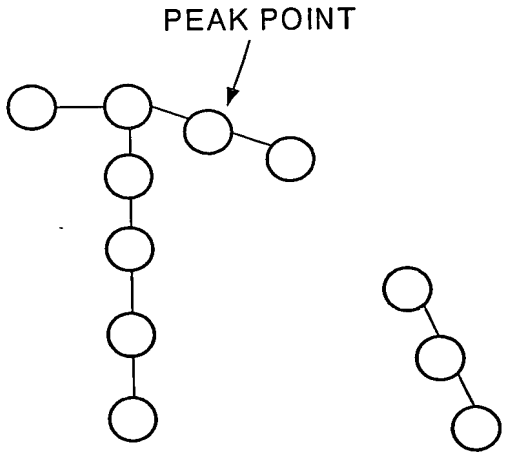


FIG. 17

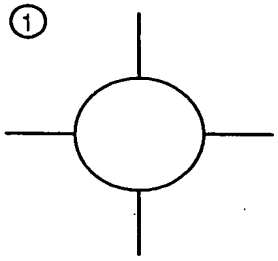
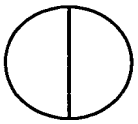
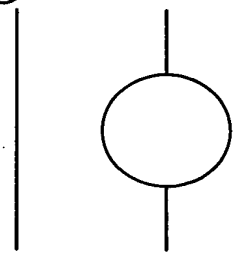
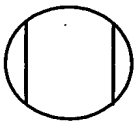
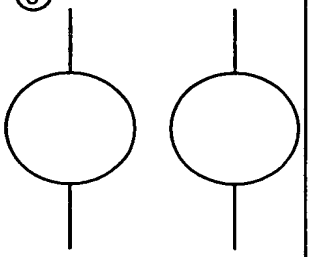
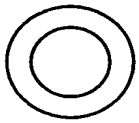
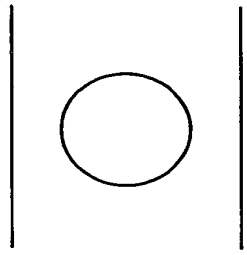
CONNECTIVITY PATTERN	COMBINATION OF PATTERNS	CONNECTIVITY PATTERN	COMBINATION OF PATTERNS
① 	UPPER LAYER : DOT, HOLE LOWER LAYER : LINE,SPACE	⑤ 	UPPER LAYER : HOLE PATTERN LOWER LAYER : HOLE,DOT,LINE, SPACE
② 	UPPER LAYER: SPACE UPPER LAYER : HOLE,DOT OR UPPER LAYER : HOLE,DOT LOWER LAYER : LINE,SPACE	⑥ 	UPPER LAYER : HOLE PATTERN LOWER LAYER : HOLE,DOT,LINE, SPACE
③ 	UPPER LAYER: SPACE UPPER LAYER : HOLE,DOT OR UPPER LAYER : HOLE,DOT LOWER LAYER : LINE,SPACE	⑦ 	UPPER LAYER : HOLE PATTERN LOWER LAYER : HOLE,DOT
④ 	UPPER LAYER: SPACE UPPER LAYER : HOLE,DOT OR UPPER LAYER : HOLE,DOT LOWER LAYER : LINE,SPACE		

FIG. 18

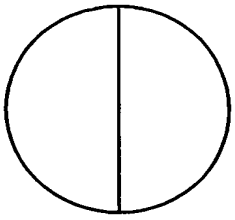


FIG. 19

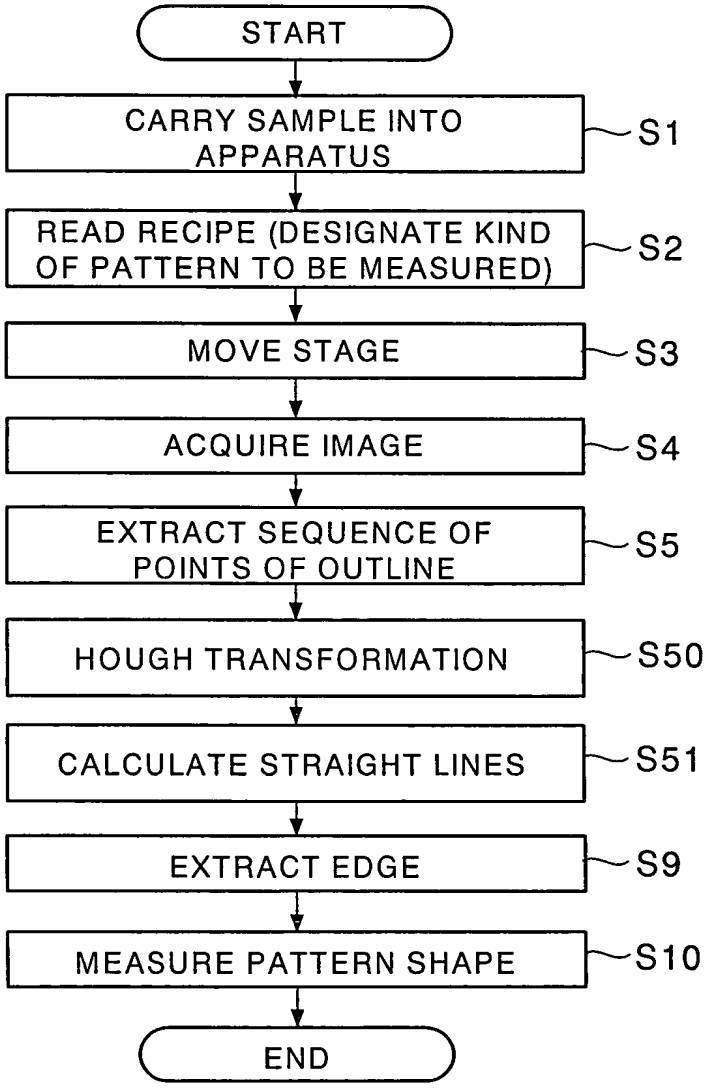

START
CARRY SAMPLE INTO APPARATUS
S1
READ RECIPE (DESIGNATE KIND OF PATTERN TO BE MEASURED)
S2
MOVE STAGE
S3
ACQUIRE IMAGE
S4
EXTRACT SEQUENCE OF POINTS OF OUTLINE
S5
HOUGH TRANSFORMATION
S50
CALCULATE STRAIGHT LINES
S51
EXTRACT EDGE
S9
MEASURE PATTERN SHAPE
S10
END

FIG. 20

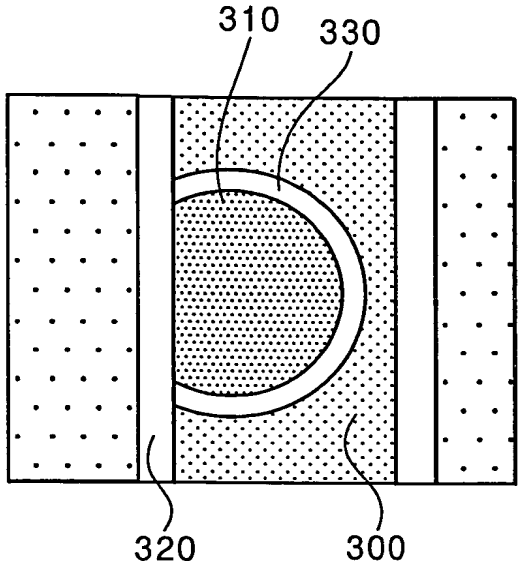


FIG. 21

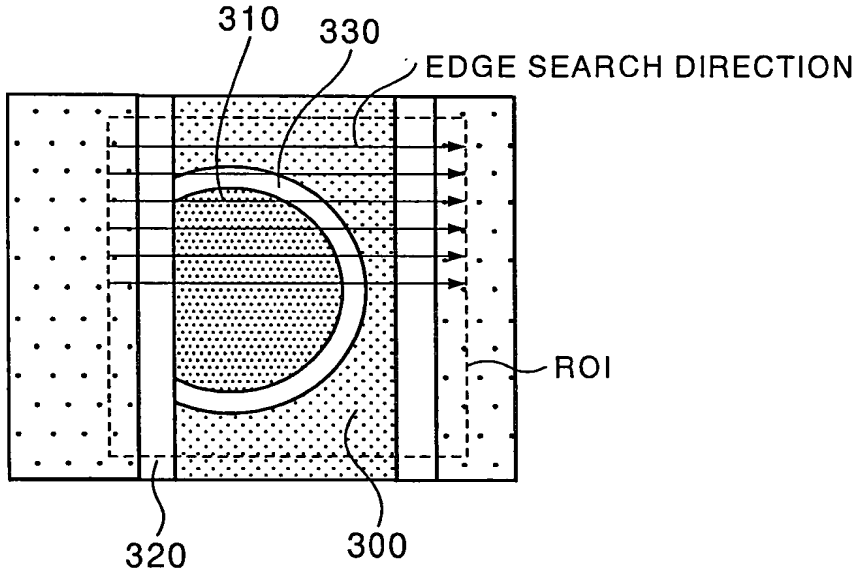


FIG. 22

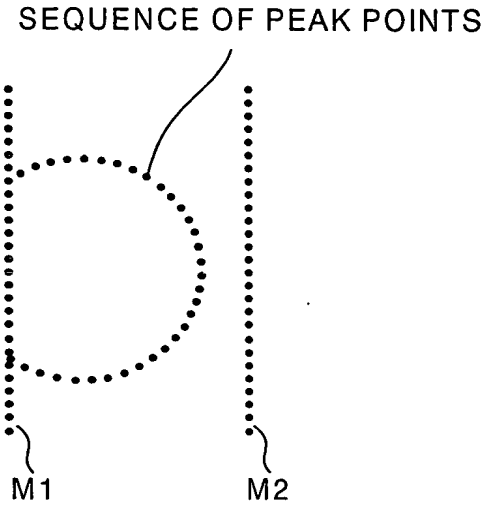


FIG. 23

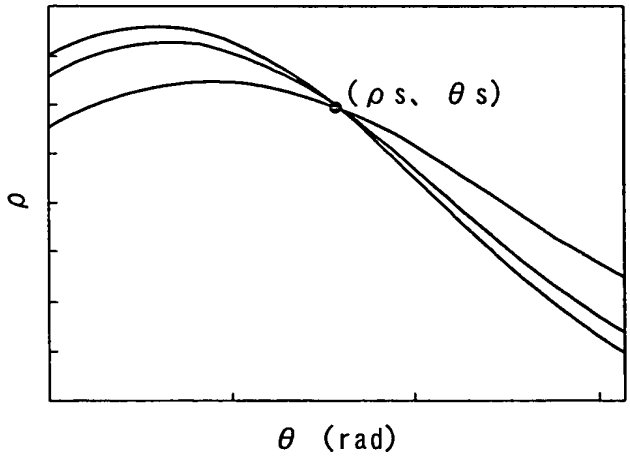


FIG. 24

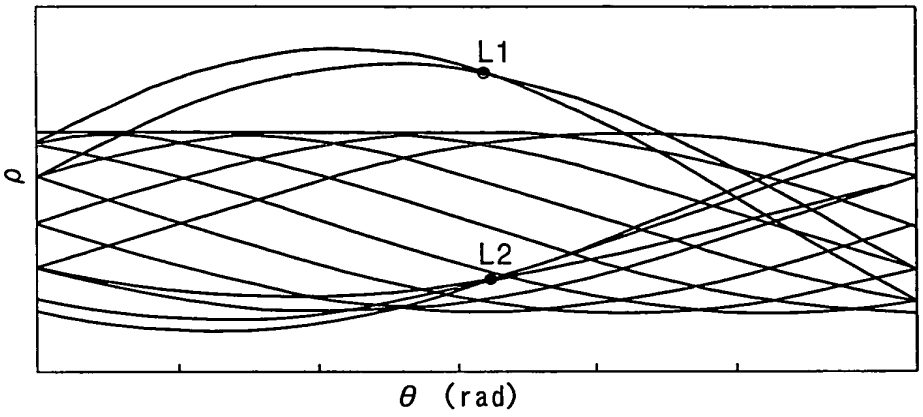


FIG. 25

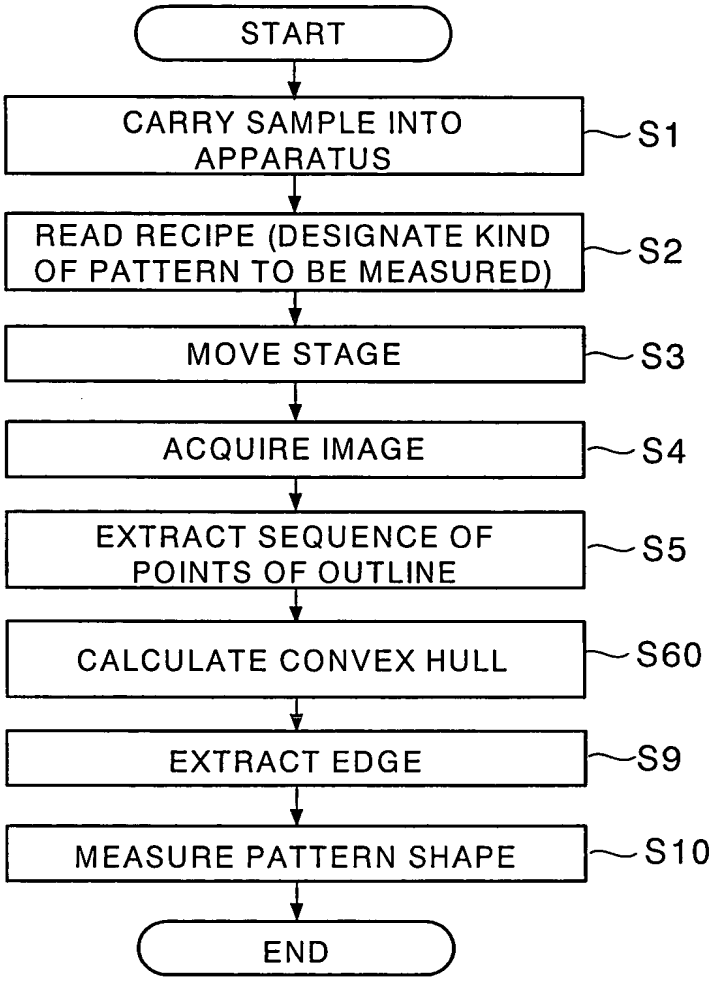

START
CARRY SAMPLE INTO APPARATUS
S1
READ RECIPE (DESIGNATE KIND OF PATTERN TO BE MEASURED)
S2
MOVE STAGE
S3
ACQUIRE IMAGE
S4
EXTRACT SEQUENCE OF POINTS OF OUTLINE
S5
CALCULATE CONVEX HULL
S60
EXTRACT EDGE
S9
MEASURE PATTERN SHAPE
S10
END

FIG. 26

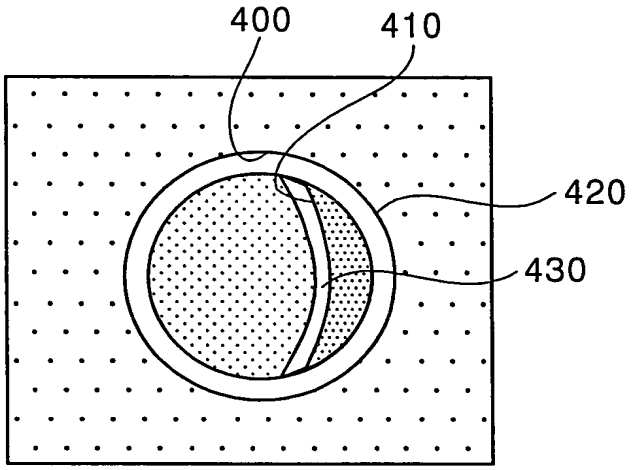


FIG. 27

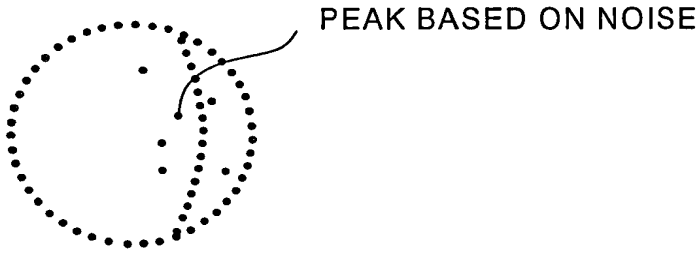


FIG. 28

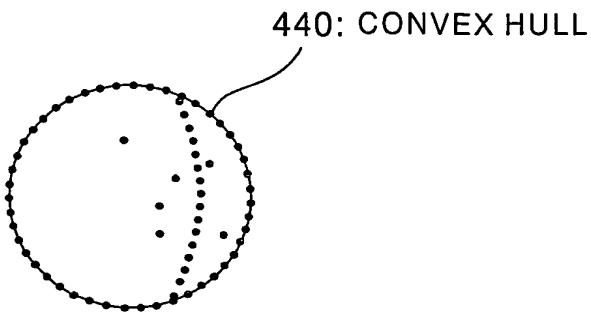


FIG. 29

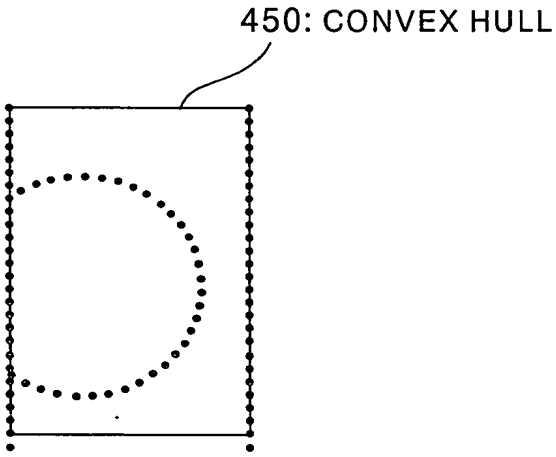


FIG. 30

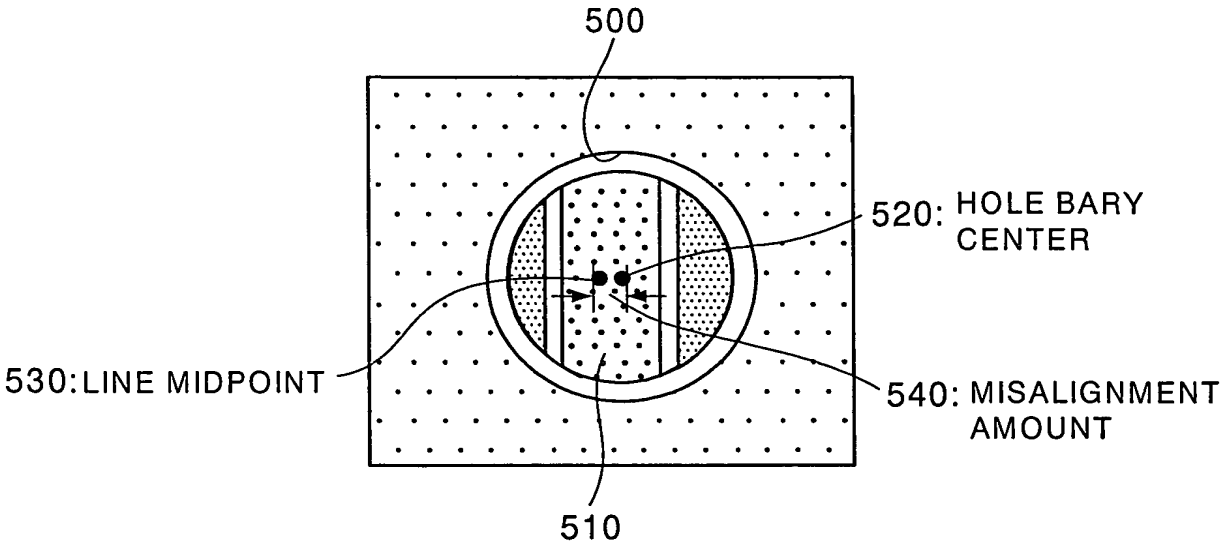

500
520: HOLE BARY CENTER
530:LINE MIDPOINT
540: MISALIGNMENT AMOUNT
510

FIG. 31

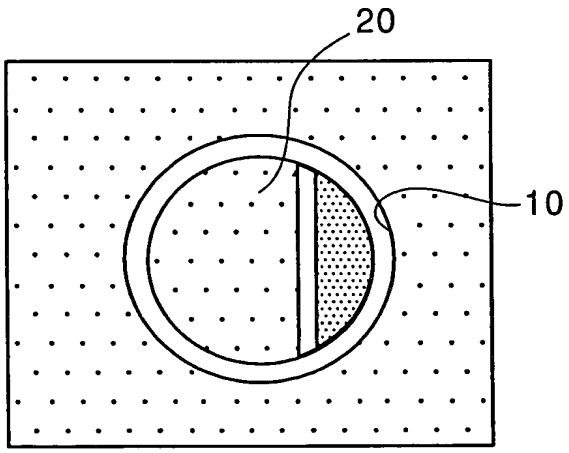

20
10

FIG. 32

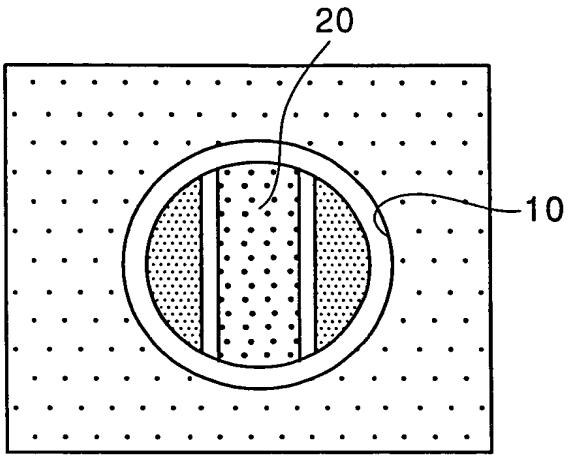


FIG. 33

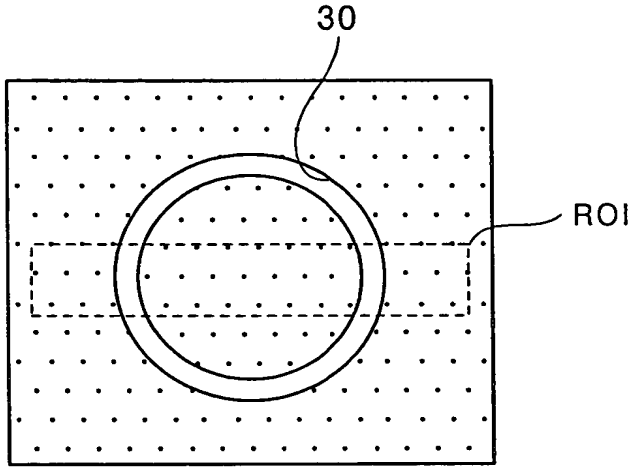


FIG. 34